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THE APPLE CURCULIO AS A PEAR PEST IN BRITISH COLUMBIA.

BY E. R. BUCKELL,

Dominion Entomological Laboratory, Vernon, B. C.

During the early summer months of 1927, 1928 and 1929, several fruit growers in the Salmon Arm district of British Columbia noticed severe injury to the small developing fruits of their pear trees. By the end of June as high as 80 per cent. of the small pears had fallen from some of the trees, and the majority of those remaining were deformed and unmarketable at harvesting time.

In June, 1929, this injury was reported to me and it was found that a small weevil was the cause of the damage.

Specimens taken in the act of oviposition upon the young pears were identified by Mr. Ralph Hopping, of the Dominion Entomological Branch, as the apple curculio, *Tachypterellus quadrigibbus* (Say).

This weevil has never before been reported as a pest in British Columbia, but has been beaten from hawthorn in several parts of the province.

The infested pear trees examined were in an apple and cherry orchard but no signs of the weevil injury could be found on anything but pear trees, although in the east this weevil is a fairly common pest of apple.

Mr. George M. List, of the State Agricultural College, Fort Collins, Colorado, informs me that they have a weevil in Colorado, which has been identified as this species, which is quite a serious pest upon the cherry. He believes it to be different from the true apple curculio, and it is possible that the form attacking pears in British Columbia may also prove different.

The outbreak at Salmon Arm was reported too late to attempt any control in 1929.

The Curculionidae is a very large family; it is represented in America north of Mexico by more than eighteen hundred species, and the subfamily Curculioninae, to which the apple curculio belongs, has more than one thousand species, among which are some very destructive pests; such as the plum curculio and the cotton-boll weevil.

From the literature we find that the apple curculio is generally distributed over the Eastern States and Canada, where it breeds abundantly in wild crab and thorn apples. As an apple pest its work has often been confused with that of the plum curculio, *Conotrachelus nenuphar* Herbst, for the two species usually work together, and deform the fruit in a similar manner.

It has come into prominence principally in Missouri and southern Illinois, but has been reported as occurring from Quebec, Connecticut and Ontario, south to North Carolina and westward as far as New Mexico. In Connecticut this species has been recorded as seriously injuring young peach trees by puncturing the twigs.

1.—C. E. Petch. "The Apple Curculio and Its Control in Quebec." (Circular No. 36, Ent. Branch. Dom. Dept. Agric. Canada. 1925).

Petch[1] states that: "The apple curculio, a native insect of wide distribution in North America, has been found in all the apple-growing sections of the Province of Quebec and annually destroys a considerable portion of the crop. From recent observations, this insect has increased enormously, and it is now one of our most destructive apple insects."

"The apple curculio does not confine its injury to the apple; it has been recorded in Quebec as attacking pear, plum, wild crab, cherry and hawthorn, and recently it has been taken from cotton in Florida."

The adult beetle is about the same size as the plum curculio; but more reddish-brown in colour; the abdomen is more robust, and the wing-covers bear four prominent humps, the anterior being much larger than those on the plum curculio. The thorax is usually striped, with three ash-gray lines and the front part of the wing-covers are more or less grayish. The female is about ¼" in length; the male is a little smaller. The snout of the apple curculio is as long as the rest of the body and is held straight forward from the head, instead of hanging down as does the snout of the plum curculio.

The beetles hibernate in grass, under rubbish and in other sheltered places, and appear on the trees soon after the petals fall. They begin to feed on the young apples as soon as they are as large as small peas, and the females begin egg-laying soon after. In feeding the beetle punctures the skin of the apple by means of the small jaws at the tip of the beak, and then eats out a cylindrical cavity in the pulp as deep as the length of the beak. Growth is stopped around the puncture, the surrounding tissue hardens and a knotty deformity results.

The cavity excavated by the female for the reception of the egg is similar to the one made in feeding but is considerably enlarged at the bottom. After placing the oval white or yellowish egg, 1/25th of an inch in length, at the bottom of the cavity, the female seals up the small external opening with a drop of excrement.

In feeding and in excavating the egg cavity very little of the skin is swallowed; it is merely torn back out of the way. This is one reason why it is so difficult to kill the beetles with an arsenical spray.

The eggs hatch in about five days and the larvae feed on the flesh of the fruit for about twenty days, when they transform to pupae within the fruit. A week later the beetles emerge, but feed very little during the summer before they enter hibernation for the winter. Hibernation usually takes place in August.

The larva is a footless, whitish grub, half an inch long, when full grown, with a hump-backed appearance due to the enlargement of the anterior abdominal segments, which prevents the larva from straightening out.

The following control recommendations are taken from the writings of Petch:[2] "In districts where the apple curculio has become a serious pest, thickets of wild crab and hawthorn in the vicinity of the orchards should be destroyed, in order to decrease natural breeding places. Likewise, since the beetles hibernate under debris, areas adjoining fence rows and stone walls should be burned over for a rod or so on each side, in April or May.

2.—C. E. Petch. "The Apple Curculio and Its Control in Quebec." (Circ. 36, Ent. Branch Dom. Dept. Agric. Canada. p. 3. 1925).

"Owing to the very small size of the majority of the injured apples little of a practical nature can be accomplished in destroying the drops. Fulton[3] states that the raking of the drops into the sunlight and leaving them for a few days is fatal to the pupae and larvae. This leads one to surmise that orchards with high-headed trees should not be severely injured.

"Spraying or dusting with poisons will give good results if they are applied at the proper time. However, the benefits from spraying will be considerably increased if the arsenicals are combined with lime-sulphur in sprays or sulphur in dusts, because sulphur in various forms acts as a deterrent. The beetles often attack the foliage or tender twigs just before or during the blossoming period, and, therefore, the pink-bud application should be delayed as long as possible. As soon as the fruits begin to form, the beetles commence to injure them. This occurs before nearly all the petals have fallen and, therefore, the calyx application should be made sooner than is usually the case or when 60 per cent. of the petals have fallen. Unfortunately, the beetles may not attack the fruit until some time after the calyx period, as happened in 1923, and in order to control such late infestations, an application should be made as soon as the beetles are noticed or a week later than the calyx spray.

"In liquid mixtures, use powdered lead arsenate 1½ lbs. or calcium arsenate ¾ lb. to 40 gallons of water or preferably lime sulphur 1¼ gallons for the pink bud application and 1 gallon for the later sprays in 40 gallons of water. If calcium arsenate is used alone in water, an equal weight of hydrated lime should be added. In dust mixtures, lead arsenate 10 lbs., or calcium arsenate 5 lbs., should be used in every 100 lbs. of dust, preferably that kind known as dusting sulphur. Calcium arsenate does not require the presence of lime when used at the above rate in dust mixtures."

This curculio is not, as a general rule, considered to be of very great economic importance and its occurrence at Salmon Arm attacking pears only is unusual, particularly as wild crab apples do not occur in that section of the province and hawthorns are rare. Its prevalence during the next few years will be watched with interest and control measures tried out in the orchards where it is found.

OBSERVATIONS ON THE BEHAVIOR OF BUMBLEBEES (BREMUS): THE ORIENTATION FLIGHT.

BY T. H. FRISON,
Illinois State Natural History Survey, Urbana, Illinois.

A. Introduction

The manner in which bees and wasps repeatedly find their way back to their nests or to certain other places has been a source of wonderment to many and the subject of serious investigations upon the part of but few. The justly illustrious Fabre in considering the homing of many insects was led to believe that wasps and bees found they way back and forth from the nest by a special sense. Essentially the same idea was advanced in a number of articles by Bethe, a writer so set upon interpreting insects as machines that he was compelled to accept an unknown sense as the explanation of the homing of bees and wasps. The

3.—B. B. Fulton. New York Agric. Exp. Sta. Geneva, N.Y. Bull. No. 475 p. 25.

studies of many investigators, particularly students of the wasps and the honeybee, have amply demonstrated that these insects are capable of recognizing objects and by this means return to their nests and to places that they visit in search of food, water, nest-building materials, etc. Bumblebees have been studied from this point of view much less than wasps and honeybees and accordingly a few remarks concerning this phase of their bionomics are presented.

The first contribution to a serious consideration of how bumblebees find their way back to the nest is that by Lie-Pettersen (1906). This was soon followed by a second contribution to the same subject by Wagner (1907). No doubt the inspiration for these studies was the ever-increasing evidence of the nonexistence of an unknown sense which was being gathered together by the students of the wasps, and the controversy as to the interpretation of the behavior of the honeybee indulged in by Bethe, v. Buttel-Reepen and Forel. After the publication of the papers by Lie-Pettersen and Wagner they were commented upon by v. Buttel-Reepen in 1907. Armbruster (1914) has also briefly related observations of his which bear on this point. The observations of Lie-Pettersen, Wagner and Armbruster all essentially support v. Buttel-Reepen's assertion that bees do not find the way back to the nest by some unknown power and that their actions are a result of a picture memory or associative memory. More recently, Rau (1924) has published a series of his interesting experiments and observations which completely agree with the findings of the writer.

B. Experiments and Observations

In the course of my biological studies frequent opportunities have occurred to observe bumblebees coming to and going from the nest. Many of these bumblebees were making their first flights from the nest and in some cases the very first flight from any nest. Before directly entering into a discussion of these flights and my interpretation of them, it is well to add some remarks of a somewhat different nature which have an important bearing on this subject; namely, to what extent bumblebees see objects. Anyone who studies live bumblebees soon perceives that bumblebees are capable of distinguishing objects and that their sense of visual perception is well developed. When a colony of bumblebees is under observation in a nesting box and is studied through transparent glass one can see that bumblebees on the comb intently detect such movements as the waving of a hand. The same applies to bumblebees resting on the top or outside of the nest. When a natural nest of bumblebees in the field is disturbed, the bumblebees which rush out to defend their nest recognize and alight upon strange objects which may be left near the nest, such as nets, collecting bags, etc. Curiously, also, the males of those bumblebees with the largest eyes such as *B. auricomus* (Robt.), *B. separatus* (Cress.), and *B. morrisoni* (Cress.), rest upon objects and dart forth from time to time at passing insects. Such actions are best and most satisfactorily explained as the result of a well developed sense of visual perception.

Because of the general uniformity of the results of my studies of the orientation flights made by bumblebees leaving the nest, no attempt is made here to describe all of such flights. Instead, a few typical examples will be given and then a general discussion of my observations will follow.

In September, 1919, I removed a nest of *B. americanorum* (Fabr.) which was situated in the ground alongside a railroad track near White Heath, Illinois,

and brought it to Champaign, a distance of some twenty miles. Three days later the entrance to the observation box containing the comb and bees was opened and careful observations made concerning the behavior of bees first leaving the nest. The general course of their flight within a radius of some thirty feet from the nest was plotted. It should be noted that all of the bees were leaving the present location of the nest for the first time and were totally unfamiliar with the city neighborhood which was the present location of their nest. Workers, young queens and males were watched and the broad outlines of their circling, zig-zag flights were plotted and timed. A study of the data so accumulated clearly showed that the worker and queen bumblebees did not hastily leave the nest without reconnoitering about the immediate vicinity. In fact, even when first leaving the nest and presumably anxious to regain their lost liberty, a wild rush was not made for the entrance and the freedom of the open. This indicates that the bumblebees somehow were aware of their changed surroundings, and instead of leaving the nest without first making a detailed study of the place in which it was located (as is done after they become accustomed to a certain location), they again resorted to orientation flights. Furthermore, they usually paused on the entrance ledge to their nest-box for a minute or so before venturing to take flight at all!

In leaving the nest the bumblebees at first flew very slowly with their heads directed towards the entrance of the nest. As their circling about gradually included more territory this facing towards the nest was lost and the speed of their flight accelerated. Contrasting with the females, however, the males which left this nest departed without making such careful studies; a fact which probably explains in a measure why so many males never return to nests after they once leave them. Of course some males do return, but the males involved in this particular series of flights never did so. In fact, neither did the young queens return to the nest, but it was interesting to note that they usually made as detailed an orientation flight as did the workers which successfully returned to the nest.

The fact that the young queens of *B. americanorum* made an orientation flight in this instance is suggestive of several possibilities. Do young queens which thus leave the nest after making an observation flight (it may not always happen, particularly if the queens are beset by males on leaving the nest or hibernate near the old nest) and which do not return to the nest again that fall retain a memory-picture of this locality until the next spring? This seems scarcely likely, but I recall two instances in which queens of different species started nests in the same places as queens of the same species the year before. Once a queen of *B. auricomus* established its nest in a hollow concrete block used in the foundation of a cabin at Homer, Illinois. I removed this nest on September 6 after some young queens had emerged and left the nest. The next year the identical place again served as the home for a colony of the same species of bumblebee. On another occasion a colony of *B. americanorum* was found in the ground near one end of a railroad bridge so late in the season that many queens had been produced and left the nest. The next year a colony of the same species was found in the same place. These two instances may be cases of coincidence but it is possible that they may denote the retention or partial retention in spring

of impressions gained by orientation flights made before hibernation. Of course, in the case of certain solitary wasps and bees, as *Anthophora abrupta* (Frison, 1922), the adults usually build their burrows in the bank where they were produced, without a previous knowledge of the place the year before. In such cases, however, the insects hibernate as larvae, pupae, or adults in the cells where the eggs which produced them were deposited.

Even though we are not willing to grant that young bumblebee queens in spring retain a knowledge of the exact place where they were produced, can we prove that they do not retain a general picture-memory of the type of area in which their nest was situated? On the basis of a general picture-memory alone we might account for the fact that various species of bumblebees exhibit preferences for certain communities, strata, etc. During my studies (1928) of *B. bimaculatus* (Cress.) it was found that young queens may remain with the nest for a considerable time and occasionally even gather pollen and nectar for the use of the colony. Such foraging demands a thorough knowledge of the location of the nest and it requires little imagination to believe that this work in the early life of the queen constitutes an experience which is useful to her when she starts a nest in spring.

I have frequently observed the orientation flights made by workers leaving a nest for the first time (workers produced in colonies by confining queens). Such flights are quite similar to those already described and very detailed. It has been my experience that such workers usually return to the nest after making a short orientation flight without gathering pollen. Workers of *B. bimaculatus* have been observed to return to the nest within seven minutes after making the first observation flight and passing from my sight. It is surprising how quickly bumblebees acquaint themselves with the location of the nest. Provisions were often brought to the nest within four hours after the bumblebees were given the liberty to forage and under conditions eliminating any previous knowledge of the vicinity. When a bumblebee is making an orientation flight it is very noticeable that objects such as trees, shrubs, etc. are encircled. In returning to a nest for the first time, somewhat of a similar performance is enacted. After bumblebees once become accustomed to the location of their nest they dispense with detailed observation flights.

Taking all facts into consideration it is evident that the faculty of sight has a great deal to do with the homing of bumblebees. The fact that objects once scrutinized by the bumblebees are again recognized and serve as landmarks implies that bumblebees retain a memory of what they see: hence the homing of bumblebees is largely the result of associative memory and no unknown power need be invoked for its explanation. We know, also, that there seems to be a similarity between the honeybee's perception of colors and that of one type of human color blindness (Frisch). Although the exact extent of color perception in the case of bumblebees requires investigation, it is evident that they do perceive some colors as well as objects. Bachman (1914) has given some evidence to show that bumblebees see colors much in the same manner as Frisch found to be true in the case of the honeybees.

Odor must also be considered a factor in aiding the bumblebees to return to their nests, but it certainly is not as important as visual perception. Among

certain other social insects, however, chemotropism may exert a much greater influence upon homing. Several times when examining a small colony of bumblebees which were reared under controlled conditions and had never been allowed their freedom, workers have flown out of the nest to attack me without first making an observation flight. Such workers occasionally found the box from which they flew, but at other times were completely lost. When I caught one of these workers and placed it near the nest-box it would crawl upon the box and try to enter; then when I shoved aside one of the top glass sections it would crawl into the nest at this opening, though it had never had an opportunity to enter the nest in this manner before. Upon one occasion a bumblebee worker hurriedly flew out of one of my observation boxes in the laboratory on the fourth floor of the Natural History Building at Urbana and out of the window without making an observation flight within the room. I gave the bee up for lost and closed the window through which it flew, only to open it again to permit the bee to re-enter the room a short time afterward. Although the bee found its way back to the laboratory window through which it flew (it made an observation flight outside of the window when it first flew out) it could not find its way back to the nest when again in the room and within a few feet of the nest box. When the cork used for plugging the entrance to its box was placed near this bee it immediately climbed upon and all around the cork, plainly showing that it recognized the odor of its nest. Such actions on the part of bumblebees denote that the sense of smell aids bumblebees in finding their nest when once they are near it. It may also conceivably be a contributing cause of bumblebee queens finding in spring nests already started by other queens; hence leading to fighting for the possession of the same nests, a habit which is so pronounced in certain species.

That chemotropism is not relied upon to a great extent by the true bumblebees at a distance from the nest seems evident from the following observations. Several times bumblebees which had never made orientation flights fell from nests which had been placed a few feet above the ground along the inner side wall of a garage. Such bees invariably searched for the nest on the ground and became lost. If chemotropism played a very important part in the locating of the nest these bees would have quickly found the nest. Again, I sometimes changed the position of a colony and found that workers coming from the field entered the wrong hole in the side of the garage and were lost, in spite of the fact that the hole leading to their nest was but a foot or so away. If chemotropism exerted a great influence on their returning they would have found the hole about a foot away because both holes, except for position, appeared about the same from the outside. There is strong evidence, however, that females of *Psithyrus* are greatly aided in finding the nests of *Bremus* in spring and early summer by a sense of smell (Sladen, 1912, and Plath, 1922). Such an interpretation also helps to explain the host fidelity which is shown by some species of *Psithyrus*.

C. Summary

Summing up all that has just been said, it seems to the writer that the homing of the true bumblebees (*Bremus*) is best explained as being due to associative memory, involving mainly visual perception and aided at closer dis-

tances by chemotropism. This conclusion is mainly in agreement with the conclusions of investigators who have studied the homing of wasps (Rau, Peckham, Marchal, etc.) and honeybees (v. Buttel-Reepen). It is also essentially in agreement with the views of Lie-Pettersen, Wagner and Armbruster. In the case of the false bumblebees (*Psithyrus*), there is evidence to indicate that chemotropism plays a more important role in the locating of the nests of their hosts.

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THE EPHEMEROPTERA OF THE NORTH SHORE OF THE GULF OF ST. LAWRENCE.*

BY J. MCDUNNOUGH,

Ottawa, Ont.

A very interesting collection of Ephemeroptera was brought back to Ottawa by Mr. W. J. Brown who spent the entire summer of 1929 on an insect faunal survey along the north shore of the Gulf of St. Lawrence, the survey extending from Trinity Bay in the west, where the fauna is still typically Canadian and Hudsonian, to Bradore Bay at the entrance to the Straits of Belle Isle, where the conditions are very similar to those found on the Labrador coast.

As the may-fly fauna of the above-mentioned region has been heretofore practically unknown the following annotated list may prove of interest. It might be noted that collections at Trinity Bay were not made until the latter part of August, and it is therefore extremely probable that numerous other species, representative of the Canadian and Hudsonian faunas, will be found earlier in the summer in this region.

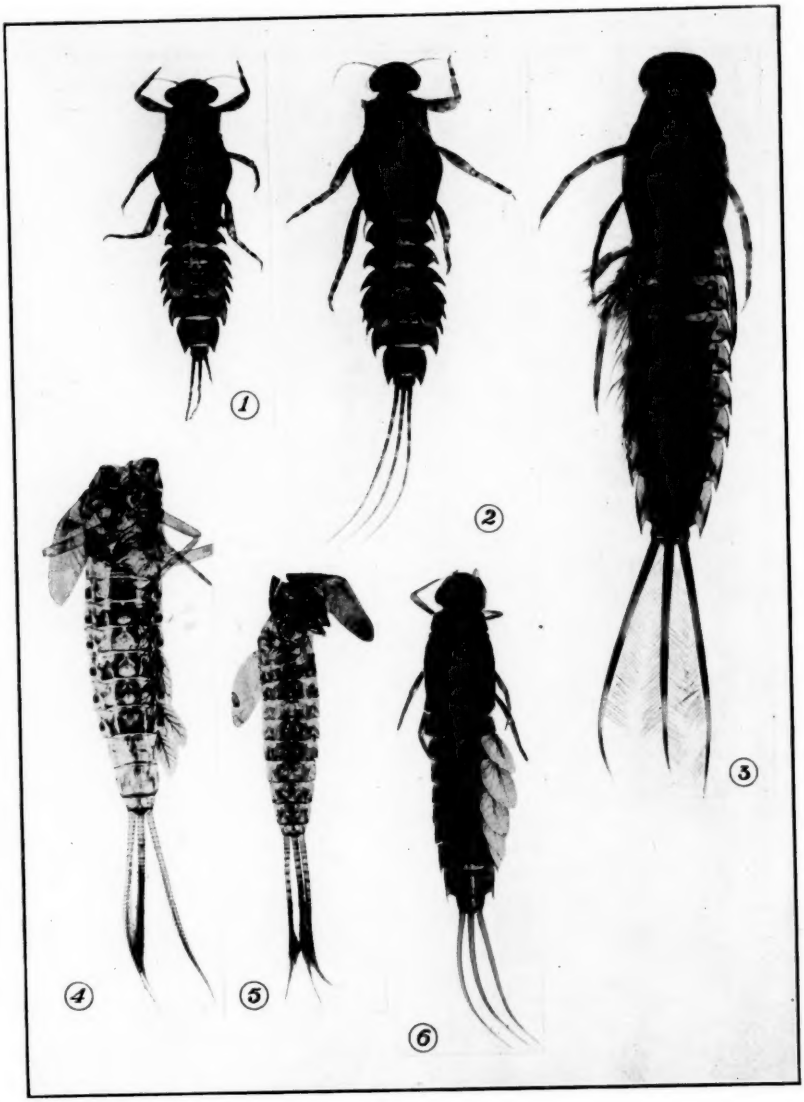
EPHEMERINAE

Hexagenia sp. 1 ♀, Trinity Bay, Aug. 20, which may belong to *affiliata* McD. Without further specimens of both sexes identification is, however, doubtful.

BAETINAE

Blasturus cupidus Say. Common. Lake Is., June 28; Little Mecatina Is., July 6.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.



NORTH SHORE EPHEMEROPTERA

Leptophlebia johnsoni McD. 1 ♂, 1 ♀, Trinity Bay, Aug. 20.

Leptophlebia debilis Wlk. 3 ♂, 4 ♀, Trinity Bay, Aug. 18-22.

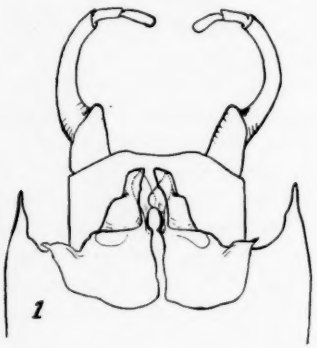
Ephemerella aronii Esb. Pet. (*norda* McD.). Long series of adults and nymphs, including adult specimens actually bred from the nymphs, were obtained at Bradore Bay beween July 21 and Aug. 1. At the time of the description of *norda*, (1924, Can. Ent., LVI, 224) I expressed the opinion in a foot note that the species might fall to *aurivillii* Bngstn. I now believe that *norda* is a synonym but that the still earlier name, *aronii* Esb. Pet., will be the correct one to use for the species. Mr. G. S. Walley in a recent paper on Western *Ephemerella* nymphs (1930, Can. Ent., LXII, 17) has discussed and figured a nymph of this Bradore Bay material; the nymphal characters only confirm me further in the belief, expressed on several occasions (*vide* Can. Ent., LVII, 171) that the genus *Chitonophora* Bngstn. has no stable characters on which it may be separated from *Ephemerella*. The nymph in general structural characters is only a slight modification of the nymphs of the typical section of *Ephemerella* (the *excrucians-inermis* section) as far as they are known, and a comparison between Walley's figures of *aronii* and presumable *inermis* will show this distinctly. The characters given in Lestage's key (1917, Ann. Biol. Lac., VIII, 357), drawn from body-shape and strength of dorsal tubercles, if applied to our North American nymphs would split the species one way, whilst the characters drawn from the adults as given by Ulmer (1929, Tierwelt Mitteleurop. IV, (3), 12/13) would split them another, proof in itself that the subdivision is unnatural. It may be that our European confreres have been misled in their conception of the typical section of *Ephemerella* by Needham's erroneous determinations of both the adult (1905, Bull. 86, N. Y. Sta. Mus. 47, Pl. X, fig. 8) and nymph (*op. cit.*, Pl. IX, fig. 1) of the genotype, *excrucians* Wlsh. I have already commented on the misdetermination of the adult when describing *needhami* McD. (1925, Can. Ent., LVII, 171) and while I realize the fact that the true nymph of *excrucians* is as yet unknown, I am quite convinced that the nymph figured by Needham cannot possibly be it. This nymph belongs undoubtedly in the *bicolor-lutulenta* group, characterized among other things by the lack of gills on the third abdominal segment, and is probably not even correctly associated with the adult of which the genitalia are figured, (*i. e. needhami* McD.). It is very unfortunate that throughout Needham's articles on Ephemeroptera such misidentifications and wrong associations occur as thereby an element of doubt is introduced which can only be eliminated by a complete checking up of all his published results.

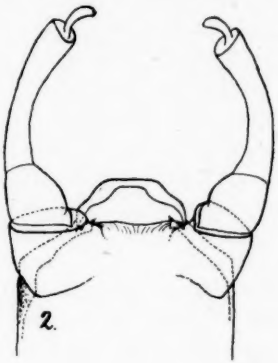
Ephemerella attenuata McD. 1 ♂, Trinity Bay, Aug. 17.

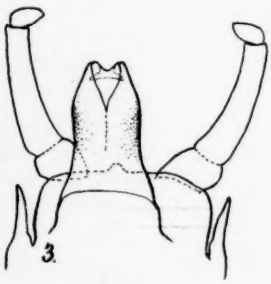
Ephemerella serrata Morg. 1 ♂, Trinity Bay, Aug. 17. Agrees well with my series of adults from Ottawa which I hold for the present under this name. If my determination be correct the species is easily separated from *sordida* McD. by its paler coloration, banded setae and (a character not mentioned in the original description) the presence of a row of four small black dots ventrally on each abdominal segment.

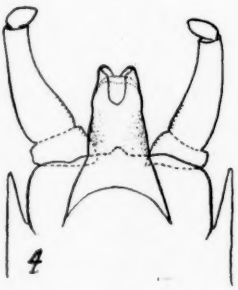
Ephemerella sordida McD. 1 ♂, 1 ♀, Trinity Bay, Aug. 18.

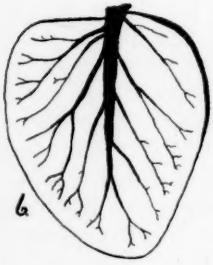
CAN. ENT. VOL. LXII. PLATE 8.

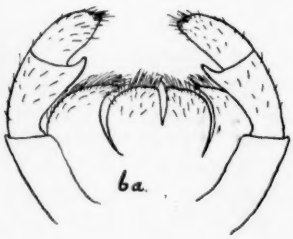


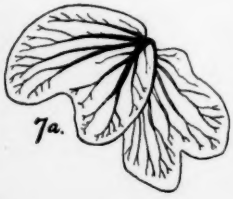


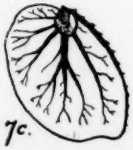












NORTH SHORE EPHEMEROPTERA

Ephemerella molita n. sp.

Female. Head dull yellowish with brown shading around the ocelli and laterally adjacent to the eyes; in the central portion, posterior to the ocelli, considerable irregular black markings and two small brown tubercles, closer together than the rear ocelli; vertex smooth. Prothorax largely blackish, the posterior margin, adjacent to the saddle-shaped portion of the mesothorax, almost straight, terminating at each side in a small wart-like excrescence; mesothorax deep brown with slight shadings of paler brown; pleura and sternum deep brown intermingled with some ruddier shades. Abdomen dorsally in color much as thorax, rather brighter and paler on posterior three segments, and a blackish shade laterally along the flange; ventrally paler, especially posteriorly, with a curved row of four minute black dots on each segment; anal plate yellowish, strongly projecting, with the lateral edges somewhat bent upwards, narrower and gently rounded apically, the whole being flatly scoop-shaped in appearance. Setae uniform dull whitish. Legs pale yellowish with traces of a brown band at apex of each femur; femora rather short, about as in *simplex* and shorter than in *attenuata;* tibiae subequal to femora; tarsi about two-thirds the length of tibiae, with the fore tarsal joints considerably shorter than in *simplex*. Wings hyaline with distinct brown shading at base, extending on primaries well beyond the great costal crossvein; veins and crossveins pale. Length of body 6 mm.; of forewing 6-7 mm.

Holotype.— ♀, Trinity Bay, Que., Aug. 17, 1929 (W. J. Brown); No. 3129 in the Canadian National Collection, Ottawa.

Paratype.— ♀, Annapolis Royal, N. S., July 21, 1928 (W. J. Brown).

The species appears to belong in the *simplex* group and can be most readily separated by the brown shades at the wing-bases and the small black dots on the abdominal sternites; this latter feature is also found in *serrata* Morg. but here the dots are larger, the setae are banded and the wings are not so distinctly brown at the base.

Ephemerella verisimilis n. sp.

Male. Intermediate in size and general characteristics between *bicolor* Clem. and *temporalis* McD. The color of thorax and abdominal tergites is a deep brown, much as in *funeralis* and without the yellow or orange shades found in *bicolor* and *temporalis;* the abdominal sternites are also noticeably darker than in either of these species. The legs are distinctly a deeper shade of yellow than in *bicolor* (which has very pale yellow legs) and in transmitted light show traces of orange patches at base, middle and apex of each femur. The setae are generally smoky in color with the usual narrow dark bands. The genitalia are very close to those of *bicolor* but considerably larger.

Female. Head slightly more shaded with brown than in *bicolor* and very much more so than in *temporalis;* on the vertex there are distinct small tubercles, about midway between the eye and the median line, which doubtless represent the head-tubercles of the nymphal stage. Otherwise very similar to the male with the usual sex distinctions. Length of body 7 mm.; of forewing 8 mm.

Nymph. Also very similar to that of *bicolor* as described and figured by Clemens (1915, Rep. Can. Mar. Biol. Sta., 123, Pl. XIV, fig. 1) but apart from its larger size, with distinct tubercles on the vertex of the head in both sexes and

with the lateral spine-like prolongations of segments 2 and 3 much better developed. From *temporalis* nymph it may be separated by the paler legs, the femora, in particular, showing no continuous brown cross-band but only indications of same as a dark spot on the anterior margin.

These nymphs were not bred through by Mr. Brown, but were taken from the river, full-grown, at a spot from which subimagos of this species were emerging. No other *Ephemerella* nymphs, except those of *aronii*, were taken at Bradore Bay and there is every reason to believe that the association is correct.

Holotype.—♂, Bradore Bay, Que., July 25, (W. J. Brown); No. 3130 in the Canadian National Collection, Ottawa.

Allotype.—♀, same data.

Paratypes.—15 ♂, 15 ♀, same locality and collector, July 21-26.

I should have hesitated to describe the above species as new if it had not been for the fact that in a good series of both nymphs and adults the above mentioned distinctions seemed to hold very constant. I have the type specimens of both *bicolor* and *temporalis* before me and have correctly associated nymphs of each of these two species, concerning which I shall have more to say in another paper. To facilitate identification I give a figure of the nymph of *verisimilis* and also sketches, drawn to the same scale, of the male genitalia of all three species.

Baetis vagans McD. 3 ♂, 3 ♀, Bradore Bay, July 19, 21.

Baetis cingulatus McD. Common between July 23 and Aug. 2 at Bradore Bay. The males of this series show a rather deeper brown thorax than the typical form from southwestern Quebec but I can detect no other differences. Nymphs of both this species and *vagans* were secured by Mr. Brown; the abdominal color pattern is very similar in both but they can be readily separated by the fact that in *cingulatus* the three subequal tails are crossed by a black band about the middle, whereas in *vagans* they are altogether pale. I expect to publish fuller details on the nymphs of the genus *Baetis* in another paper.

Baetis pluto McD. 2 ♂, 1 ♀, Trinity Bay, Aug. 20.

Baetis pygmaeus Hag.? 5 ♀, Trinity Bay, Aug. 20-22. These females do not agree exactly with our Ottawa specimens to which I have applied the name *pygmaeus* but they may represent the true species, described from the St. Lawrence (Osten Sacken) from a single female, of which only a forewing and a portion of the thorax exist in the Cambridge Museum of Comparative Zoology. I have an exactly similar series of females from Knowlton, Que. and hope to study the group more closely in connection with this latter material. I have already commented (1925, Can. Ent., LVII, 172) on the difficulties attendant on the correct determination of *pygmaeus*.

Centroptilum album McD. 1 ♂, Bradore Bay, July 26; 1 ♀, Trinity Bay, Aug. 20, may also belong here.

A single mature *Centroptilum* nymph was also secured by Mr. Brown at Bradore Bay which I presume may be associated with this species. In this specimen most of the legs and some of the gills were missing and the antennae and caudal cerci were partly broken; however, since the nymphs of all our North American *Centroptilum* species have heretofore been unknown, I have thought it advisable to give as full details as possible in the accompanying figures of the various structural characters and the type of abdominal maculation. Compared

with Eaton's figures of similar details in the nymph of *Centroptilum luteolum* it will be seen that the mouthparts of *album* are very similar but show certain differences in the finer characters (*e. g.* the shape of the second joint of the labial palp); the gills, too, are less pointed and much as in *Baetis*. Needham and Lestage use the pointed nature of the gills as one of their key characters in the separation of *Centroptilum* nymphs from those of *Baetis;* this character would, however, appear to be individual rather than generic and the shape of the terminal joint of the labial palp would seem to be the safest one to use when differentiating such nymphs.

Cloeon ingens McD. 8 ♂, 13 ♀, Trinity Bay, Aug. 17-23, taken as subimagos and bred through. This species was described (1923, Can. Ent., LV, 44) from a single male from Nordegg, Alta., with which I doubtfully associated a female from Banff, Alta.; this female, however, proves to belong to the closely allied *implicatum* McD., which I separated later from *ingens* on account of the pale yellow legs. The Trinity Bay females are more or less unicolorous deep brown with smoky brown legs as in the male sex.

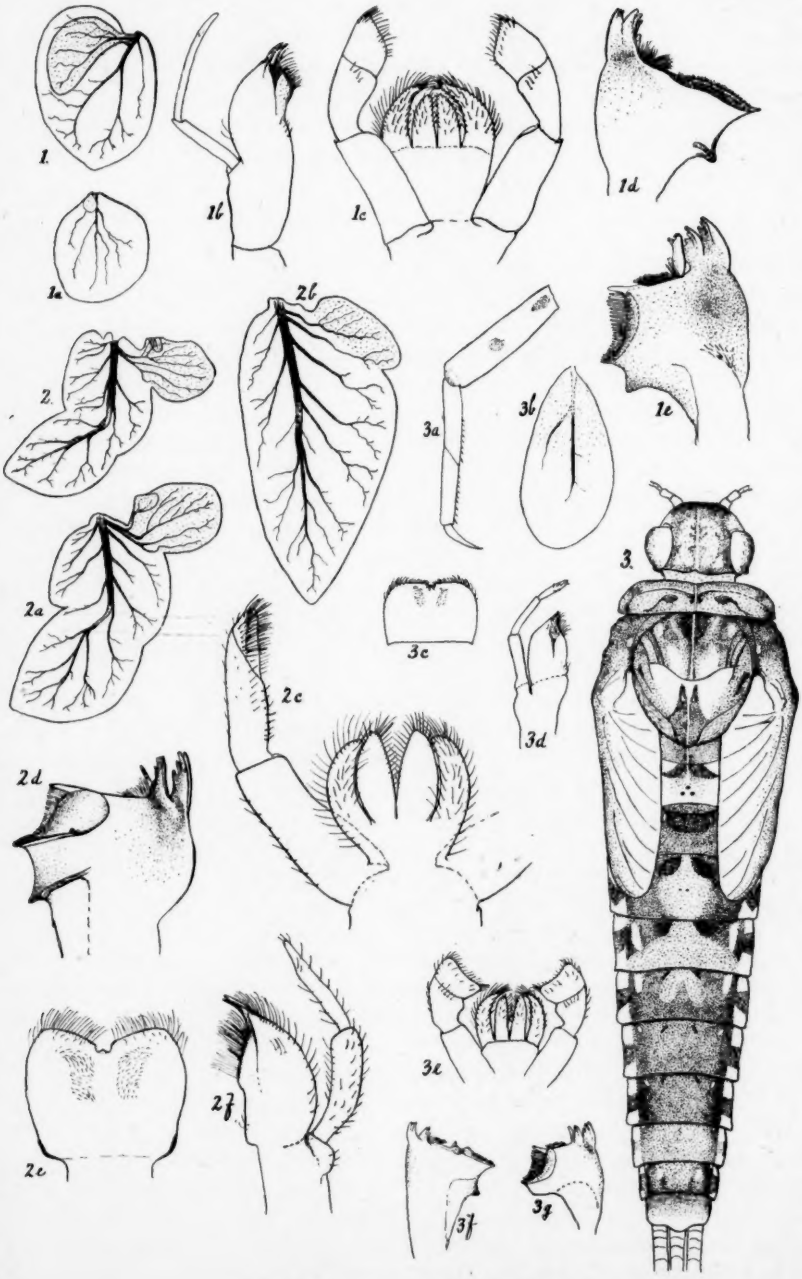
Mr. Brown also secured a number of nymphal skins floating on a small lake, from which the subimagos of *ingens* were emerging, one skin being still actually attached to the subimago. A photograph of the abdominal portion of one of these skins gives a good idea of the maculation which is evidently quite close to that of the *Cloeon* species listed by Clemens (1915, Rep. Can. Mar. Biol. Sta. 126, Pl. XIV, fig. 3) as *dubium* Wlsh. but which, after an examination of Clemens' material, I have determined to be *rubropicta* McD. I also figure certain of the gills and mouth parts, as well as the adult male genitalia, heretofore unfigured.

Cloeon simplex McD. 1 ♂, 2 ♀, Trinity Bay, Aug. 18, 20, 22.

Cloeon rubropicta McD. 5 ♂, 4 ♀, Trinity Bay, Aug. 18, 19, 20, 22.

Callibaetis hageni Eat. (*tessellatus* Hag. *praeoc.*). 1 ♂, 6 ♀, Trinity Bay, Aug. 18-22, taken at the same small lake as *Cloeon ingens;* nymphal skins were also found floating on the water.

This species runs according to Banks' key (1900, Trans. Am. Ent. Soc., XXVI, 248) to *hageni,* having in the female a dark brown costal vitta with numerous other dark streaks and blotches on the veins; as, however, the original type was a subimago from Washington State, we have only Eaton's word for it that the female imago he figures is correctly associated. This group (*viz.* those species with dark brown costal vitta in the females and fairly numerous crossveins) is a very difficult one; not only is there considerable variation in position and number of the crossveins as well as in the intensity of the dark wing maculation in individuals taken at the same time, but there is a further difference between specimens taken in the early spring and those found in late summer and which presumably constitute two broods of a single species. A very limited amount of breeding done in the spring of 1929 with nymphs taken around Ottawa has convinced me that there are two other distinct species in the group besides *hageni* but just what names (if any) are applicable to these and what characters may be used in separating the adults has not as yet been worked out. Meanwhile it seems advisable to record as fully as possible the nymphal characters of the Trinity Bay species and I, therefore, offer a photograph of the abdominal por-



NORTH SHORE EPHEMEROPTERA

tion of the cast skin for the sake of the maculation and also figures of the first three gills and some of the mouth parts. The shaded portion of the gill in my figures is that portion which is normally turned under, thus forming the so-called double lamellae and it, in turn, may also show a minute flap, as indicated. As far as I am able to judge from my studies the mouth parts are very similar throughout the genus but in the gill-shape and the amount of tracheation in each gill we may have characters which, if used with caution, form a basis for specific separation.

HEPTAGENIINAE

Sparrea sp. A very interesting series of nearly mature nymphs was taken near the Thunder River on June 10 but unfortunately there was no opportunity of breeding them through to the adult stage. A detailed study led me to suspect that they belonged to the genus *Sparrea* Esb. Pet., a genus heretofore unknown from our North American fauna, and this was confirmed by Dr. Esben Petersen to whom I submitted specimens. Whether our North American species is distinct from the European *norvegica* Esb. Pet. is a matter which cannot be decided at the present time; a comparison, however, between the figures I herewith present and those given by Esben Petersen (1916, Mem. Acad. Imp. Sci. Petrog., XVIII (12) 10, figs. 14, 15) for *norvegica*, shows at least a very close relationship.

Siphlonurus phyllis McD. This species, heretofore only known from Alberta and northern Manitoba, was found quite abundant at Natashquan, Aug. 5-10. Nymphs, as well as adults, were secured and bred through so that the association is definitely established. The nymph is evidently rather closely related to that of *alternatus* Say, possessing double lamellae on all gills, although in the seventh pair one lamella is reduced to a mere flap at the base and is easily overlooked. This character would place both *phyllis* and *alternatus* in the genus *Siphlurella* Bngstn. but, since all other structural characters in both nymph and adult are typically Siphlonurid, I do not believe that a sole difference in gill-structure justifies the retention of Bengtsson's generic term; in spite of Lestage's argument in favor of *Siphlurella* (1914, Bull. Soc. Ent. Belg., VI, 47-53) I follow Ulmer (1920, Stett. Ent. Zeit., 131) in sinking *Siphlurella* to *Siphlonurus*. I give a corrected figure of the male genitalia; the figure given of these parts at the time the species was described was drawn from the dried specimen and the finer details were obscured by exhudations.

Siphlonurus alternatus Say. Quite common at Trinity Bay, Aug. 17-20.

Ecdyonurus frontalis Bnks. 1 ♂; 1 ♀, Trinity Bay, Aug. 19, 20. I am rather uncertain as to the identification without a longer series; the *canadensis* group needs a very careful revision before true species and mere pattern-forms can be satisfactorily separated.

Ecdyonurus rubromaculatus Clem. 1 ♀, Trinity Bay, Aug. 20. As far as I can judge seems best placed here.

EXPLANATION OF PLATES

PLATE 7.

1. Male nymph of *Ephemerella verisimilis* n. sp. 2. Female nymph of *Ephemerella verisimilis* n. sp. 3. Nymph of *Siphlonurus phyllis* McD. 4. Nymphal skin of *Callibactis hageni* Eat. 5. Nymphal skin of *Cloeon ingens* McD. 6. Nymph of *Sparrea* sp.

PLATE 8.

1. Male genitalia of *Siphlonurus phyllis* McD. 2. Male genitalia of *Cloeon ingens* McD. 3. Male genitalia of *Ephemerella temporalis* McD. 4. Male genitalia of *Ephemerella veris-*

imilis n. sp. 5. Male genitalia of *Ephemerella bicolor* Clem. 6. Nymph of *Sparrea* sp., 4th gill; 6a—labium; 6b—maxilla. 7a. Nymph of *Siphlonurus phyllis*, 2nd gill; 7b—3rd gill; 7c—7th gill.

PLATE 9.

1. *Cloeon ingens* nymph, 4th gill; 1a—7th gill; 1b—maxilla; 1c—labium; 1d—right mandible; 1e—left mandible. 2. *Callibaetis hageni* nymph, 1st gill; 2a—2nd gill.. 2b—3rd gill; 2c—labium; 2d—left mandible; 2e—labrum; 2f—maxilla. 3. *Centroptilum album* nymph; 3a—hind leg; 3b—2nd gill; 3c—labrum; 3d—maxilla; 3e—labium; 3f—right mandible; 3g—left mandible.

SOME NEW WORLD HIPPOBOSCIDAE (DIPTERA PUPIPARA).

BY G. F. FERRIS,
Stanford University, California.

For the material here reported upon I am indebted to Dr. L. H. Dunn, of the Gorgas Memorial Laboratory, and Prof. C. H. Vorhies, of the University of Arizona.

Genus *Stilbometopa* Coquillett.

1899. Coquillett, Can. Ent. 31: 336.

Hippoboscidae belonging to the group of *Ornithomyia*, with functional, non-caducous wings which possess three "cross-veins" and consequently an anal cell, the wings entirely devoid of setulae; abdomen without a dorsal median area of transverse striations; ocelli lacking; antennae large, flattened, divergent; pleurotergite of the mesonotum with a conspicuous process on each side of the body; scutellum short, very broad, with the posterior margin but slightly rounded and bearing a close-set fringe of large setae; claws three-toothed.

Type of the genus, *Ornithomyia fulvifrons* Walker.

Notes: Three species have heretofore been referred to this genus, *S.* (*Ornithomyia*) *fulvifrons* Walker from Jamaica, *S.* (*Ornithomyia*) *impressa* (Bigot) from California and *S. podopostyla* Speiser from Brazil. A fourth species, doubtfully distinct from *S. podopostyla*, and tentatively named by Lutz, Neiva and Costa Lima, *S. columbarum*, is recorded from Brazil. All the species are characteristically from columbine and gallinaceous birds.

Two species are at hand, one undoubtedly *S. impressa* (Bigot). The other I am here describing as new following a definite program of thus treating forms which can not be definitely connected with named species. On the basis of these two I present herewith a few notes on certain features of the morphology of the genus.

The palpi (Fig. 2*B*) are extremely small.. The antennae are of the typical ornithomyiine form, flattened and leaf-like, and most nearly resemble those of *Ornithoctona*, to which I believe this genus to be most closely related. The thoracic spiracles are extremely large and in the case of the mesothoracic pair are surrounded by a conspicuous, dark area which appears in Fig. 1. The pleurotergal process, which is extraordinarily developed is shown in relation to surrounding parts in Fig. 2*E*. The halteres, as will be seen in this same figure, are exceedingly small. The wings are very similar in the two species at hand, and in both are entirely destitute of the vestiture of minute setulae which occurs on most Hippoboscidae.

The abdomen is of the type characteristic of the ornithomyiine group, is for the most part membranous and is very thickly beset with setae which are borne upon small, sclerotic tubercles. Males are not available.

Stilbometopa ramphastonis n. sp.

Figs. 1, 2.

Material examined. A single female, from *Ramphastos swainsonii,* Camp Pital, Chiriqui Province, Panama, July 1929 (*L. H. Dunn*). This is deposited in the collections of Stanford University.

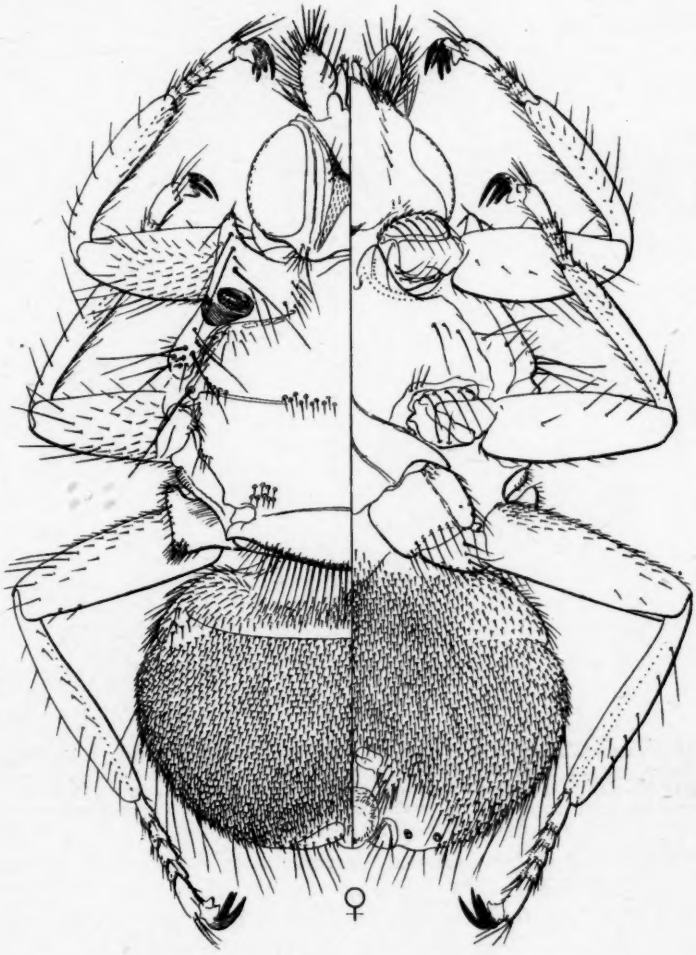


Fig. 1. *Stilbometopa ramphastonis* n. sp., female, wings removed.

Female (Fig. 1). Length, on slide, 9 mm., length of wing 9 mm. Head, with the antennae and their hairs, of a light red color both dorsally and ventrally, the eyes dark; thorax above glistening black, with a greenish luster, the humeral processes pale, the scutellum black, venter of thorax black; front legs reddish, others black; wings brownish.

As compared with *S. impressa* this species is distinguished structurally chiefly by the form of the anepisternum of the mesothorax. In *S. impressa* (Fig. 2*G*) this sclerite forms a short, angular, truncate process, while in *S. ramphastonis* (Fig. 2*F*) it is smoothly rounded and not at all prominent. The pleurotergal process has the posterior angle obtuse, while in *S. impressa* (Fig. 2*E*) it is quite strongly produced. The head in *S. impressa* is noticeably shorter and relatively broader, with the antennae apparently smaller and shorter. Otherwise there seems to be but little difference between the two species except in color, *S. impressa* having the head black. Also in *S. impressa* the wings are distinctly paler, being quite hyaline, and the anal veins is very indistinct.

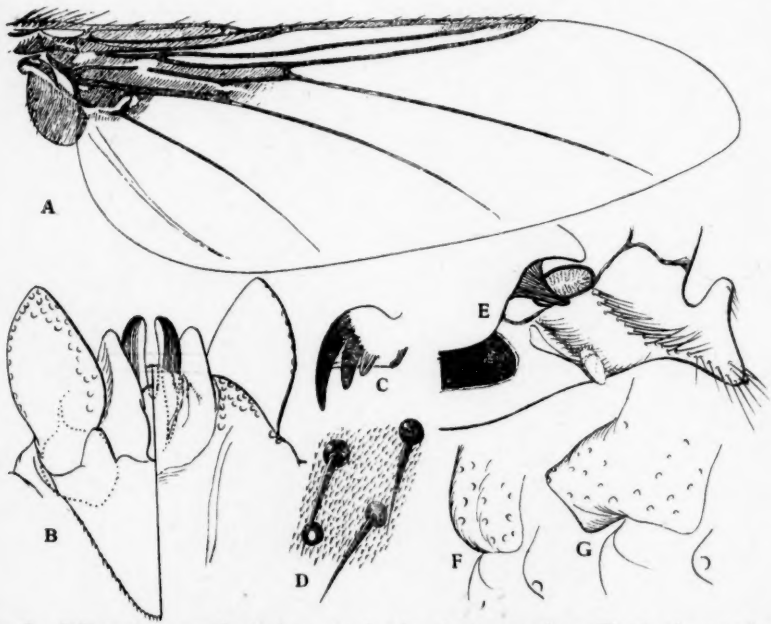


Fig. 2. *Stilbometopa ramphastonis* n. sp. *A*, wing, to same scale as Fig. 1, pigmentation indicated only at base; *B*, anterior region of head, only insertions of setae indicated; *C*, single claw; *D*, portion of derm of abdomen; *E*, ventral aspect of portion of thorax, posterior coxa removed; *F*, profile of pre-alar, lateral margin (anepisternum) of thorax; *G*, same of *Stilbometopa impressa* (Bigot).

On the basis of the published descriptions, *S. ramphastonis* is apparently quite close to *S. fulvifrons* (Walker), agreeing with this species in color. However, the wings of *S. fulvifrons* are described as being pale. *S. podopostyla* is described as having the head yellow, and may possibly be different.

It is entirely possible that all these three species, *S. fulvifrons*, *S. podopostyla* and *S. ramphastonis* are the same thing.

Stilbometopa impressa (Bigot).

Fig. 2.

1922. *Stilbometopa impressa* (Bigot), Ferris and Cole, Parasit. 14:201; figs. 17-18.

Previous records. Known only from a half dozen specimens, all from "quail" in California.

Present record. Two specimens from Gambel quail, *Lophortyx gambelii,* Rincon Mts., Ariz., Nov. 14, 1928 (*University of Arizona*).

Notes: Some observations on the morphology of this species are given above and nothing more need be said concerning it.

Genus *Microlynchia* Lutz, Neiva and Costa Lima.

1915. Lutz, Neiva and Costa Lima, Memor. do Inst. Osw. Cruz 7: 185.

Hippoboscidae belonging to the group of *Olfersia,* with functional, non-caducous wings which possess but a single cross-vein and consequently are without an anal cell; abdomen with a dorsal, median area of transverse striations; ocelli present or absent, borne in a pit; antennae short, cylindrical, the clypeus very short and produced laterally into points which much exceed the antennae; pleurotergite of mesonotum conspicuously and conically swollen; claws three-toothed.

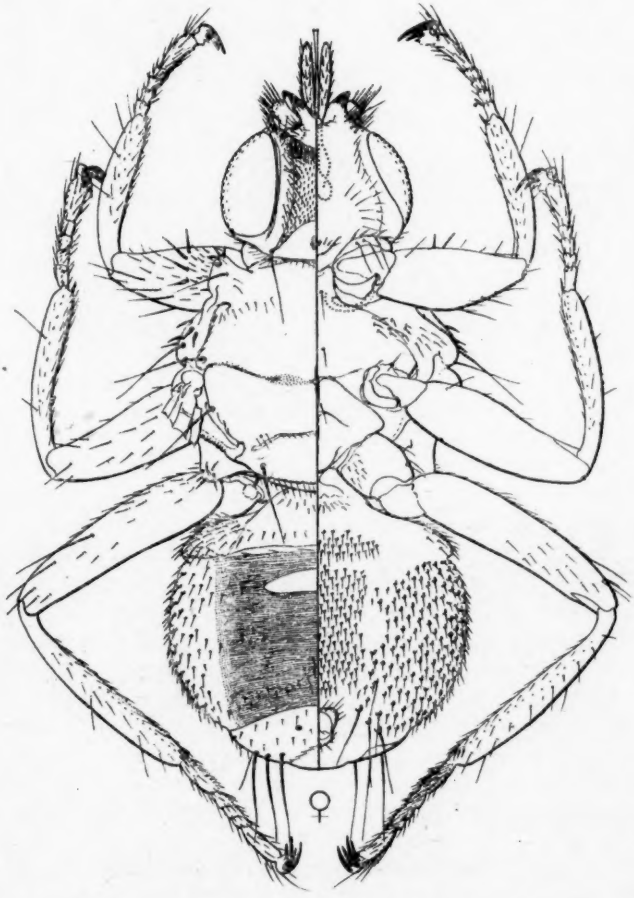


Fig. 3. *Microlynchia pusilla* (Speiser), female, wings removed.

Type of the genus, *Olfersia pusilla* Speiser.

Notes: The genotype is the only species at present referred to this genus. Technical characters for its separation from the closely related olfersiine genera are readily available in the single crossvein and the rounded scutellum, which lacks the lobate fringe at the lateral angles that appears in *Pseudolynchia* (=*Lynchia* of authors). The presence of the ocelli, if it were not a variable character, would separate the genus from all its immediate relatives except *Ornithophila*. Of the three specimens examined in slide preparations, which make detailed study possible, one lacks the ocelli entirely, their position being indicated by a pore-like pit similar to that which is present in some species of *Lynchia* (=*Olfersia* of authors); one has three very minute but quite distinct ocelli and the third has two. In the latter cases the ocelli are borne in a distinct pit.

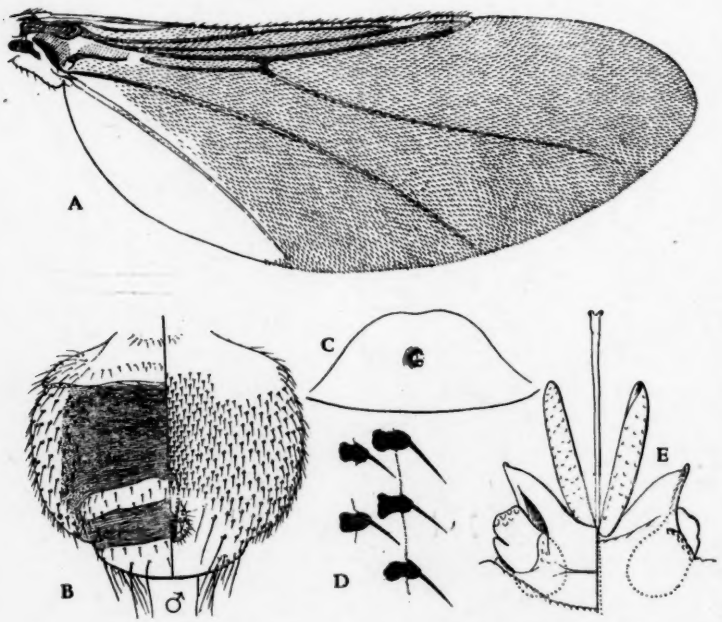


Fig. 4. *Microlynchia pusilla* (Speiser), *A*, wing, to same scale as Fig. 1; *B*, abdomen of male; *C*, vertical triangle of specimen with two vestigial ocelli; *D*, portion of derm of abdomen; *E*, anterior portion of head, insertions only of setae shown.

Microlynchia pusilla (Speiser).

Figs. 3, 4.

1902. *Olfersia pusilla* Speiser, Zeitschr. fur syst. Hymenopt. und Dipt. 2: 155.

1915. *Microlynchia pusilla* (Speiser), Lutz, Neiva and Costa Lima, Memor. do Inst. Osw. Cruz. 7: 185; pl. 27, f. 6, pl. 28, f. 6.

Previous records. Recorded by Speiser from Cuba without indication of host, and by Lutz, Neiva and Costa Lima from Brazil from *Columbigallina talpacoti, Leptotila rufoaxilla* and *Scardapella squamosa*, these hosts all being columbine birds.

Present record. Several specimens from squabs of domestic pigeon, Thatcher, Arizona, Sept. 15, 1919 (*University of Arizona*).

Notes: As far as I am aware this species has not before been recorded from the continent of North America. The common pigeon hippoboscid is *Pseudolynchia maura*, a species that has been attracting some attention recently because of its increasing abundance in pigeon lofts. The two species are readily separable by the unaided eye on the basis of size alone, *P. maura* reaching a body length of 6 mm. with a wing length of as much, while *M. pusilla* is but 4 mm. with a wing length of not over 4.5 mm. For this species the name of "little pigeon fly" might well be used, as suggested by Mr. F. C. Bishopp in a letter to the writer.

The accompanying figures will make the characteristics of the species clear. The color of pinned specimens is a quite uniform pale brown, verging on yellowish.

Genus *Lynchia* Weyenberg.

This genus, as here understood, is the *Olfersia* of most authors.

Lynchia americana (Leach).

Fig. 5*A, D, F.*

1927. *Lynchia americana* (Leach), Ferris, Can. Ent. 59:248; figs. 2, 3 (not fig. 1).

The presence in the material at hand of certain specimens which raise the question of specific limits in connection with this species is the reason for a further discussion of it.

Lynchia americana is characteristically a parasite of owls in North America and specimens are at hand from several species of this host group, ranging from the Atlantic coast to the Pacific. It has also been recorded from various species of hawks, but specimens available from a hawk appear to be a very closely related, but certainly distinct species. The question then arises as to the amount of variation present in specimens which may reasonably be regarded as *L. americana*. Eighteen specimens that may be so regarded have been examined in slide preparations and two more pinned individuals are at hand.

Representative measurements from slide mounts are as follows. The largest specimens, from great horned owl, West Virginia are 9 mm. long from base of palpi to apex of abdomen, with a wing length of 8 mm. The smallest, from "owl," California is 6.5 mm. long with a wing length of 7 mm. Another specimen from great horned owl in Massachusetts is 7 mm. long with a wing length of 7,5 mm., and one from "horned owl" in California is 8 mm. long with a wing length of 8 mm. It is thus evident that size is quite variable but that in general the species may be regarded as "large."

In morphological characters there appears to be no significant variation. There are very slight differences in the degree of hairiness but none which are at all significant. The distribution of the minute setulae on the wing is quite constant, there being but little tendency for these setulae to invade the basal portion of the wing (Fig. 5*A*). There is a slight variation in the position of the "first cross-vein," but it is always well beyond the end of R1. The sub-costa never attains the costa. The front (Fig. 5*F*) is relatively broad, being nearly twice the width of an eye. The vertex sometimes bears a minute pit, but this is sometimes lacking. The humeral processes (Fig. 5*D*) are broad and stout.

In the pinned specimens the thorax is of a uniform brown color, without any evidence of a pale median stripe.

Lynchia angustifrons (Van der Wulp).

Fig. 5*E*, *G*.

1903. *Olfersia angustifrons* Van der Wulp, Biol. Cent. Am. Dipt. 2:430; pl. 13, f. 3, 3a.
1903. *Olfersia angustifrons* Van der Wulp, Austen, Ann. and Mag. Nat. Hist. (7) 12:265.
1916. *Olfersia angustifrons* Van der Wulp, Swenk, Jour. New York Ent. Soc. 34: 130.

Previous records. From Teapa, Tabasco, Mexico and Rio Sucio, Costa Rica without indication of host (Van der Wulp); from Oaxaca, Oaxaca, Mexico, without host (Austen); from a trogon, Vera Cruz, Mexico (Swenk).

Present record. A male and a female from toucan, *Ramphastos swainsonii*, Camp Pital, Chiriqui Province, Panama (*L. H. Dunn*).

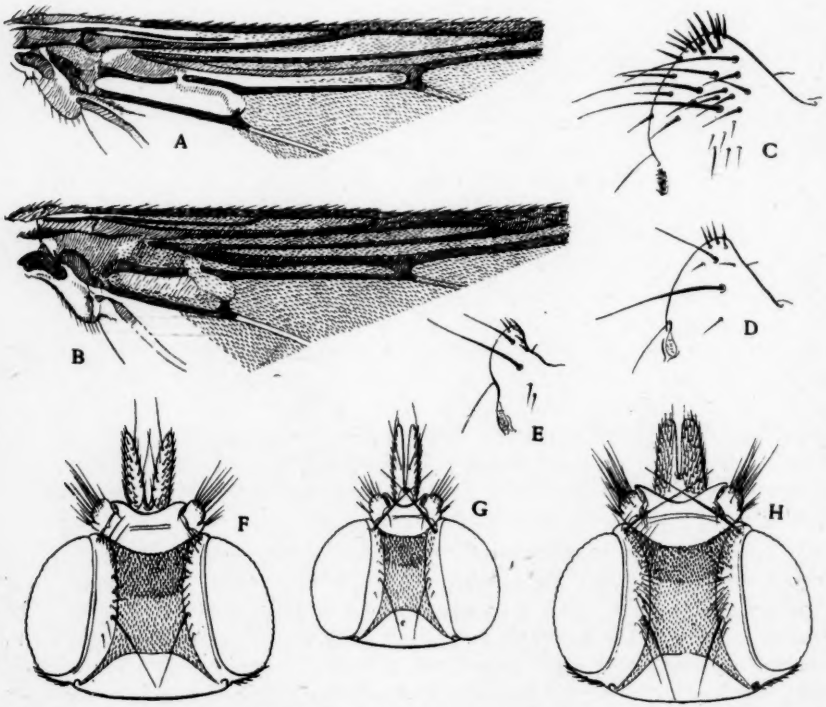


Fig. 5. *Lynchia americana* (Leach), *A*, basal portion of wing; *D*, humeral process; *F*, head. *Lynchia angustifrons* (Van der Wulp), *E*, humeral process; *G*, head. *Lynchia intertropica* (Walker), *B*, base of wing; *C*, humeral process; *H*, head.

Notes: The identification of the specimens at hand with this species is somewhat dubious, for there may be more than one species having the general characters assigned to *L. angustifrons*. But there is quite close agreement with the descriptions as far as they go and the identification seems reasonable.

Of the two specimens available, the female, on the slide is about 5.25 mm. long, with a wing length of 5.5 mm., the male about 4.75 mm. with a wing length of 5 mm. It is a species with the body almost uniformly black and with the wings distinctly dusky.

In its structural characters the species is very close to *L. americana*. The wings are almost the same, with the same distribution of setulae, the sub-costa interrupted and the "first cross-vein" well beyond the end of R_1. The wing membrane, however, is distinctly dusky.

The head (Fig. 5*G*) has the front distinctly narrower than in *L. americana* and the palpi are proportionately much longer and more slender. The vertex bears a small median pit. The humeral processes (Fig. 5*E*) are noticeably acute and slender as compared with those of *L. americana* (Fig. 5*D*). The head and thorax are very sparsely haired. The abdomen presents no significant characters which will separate the species from *L. americana*.

Lynchia intertropica (Walker).

Fig. 5 *B, C, H.*

1849. *Ornithomyia intertropica* Walker, List Dipt. Ins. Brit. Mus. 4: 1144.
1903. *Olfersia acarta* Speiser, Zeitschr. fur syst. Hymenopt. und Dipter. 2: 149.
1903. *Olfersia intertropica* (Walker), Austen, Ann. and Mag. Nat. Hist. (7) 12: 264.
1916. *Olfersia intertropica* (Walker), Swenk, Journ. New York Ent. Soc. 24: 129.

Previous records. Recorded by Walker from the Galapagos Islands; by Speiser, as *O. acarta,* from "short eared owl" and without host from the Hawaiian Islands; by Austen, without indication of host, from Brazil and Mexico; by Swenk from Mexico, without host.

Specimens examined. A number of specimens from "red-tailed hawk," Tucson, Arizona (*University of Arizona*).

Notes: I am inclined to regard this identification as rather definite. Speiser gave a very detailed description of the color and general characteristics of his *Olfersia acarta,* which Austen after comparison with the types of *O. intertropica* (Walker) has reduced to synonymy with the latter, and with this the specimens at hand agree closely.

Although the species is in general very similar to *L. americana,* it is readily distinguishable. Like *americana,* it is a large species with a body length, in slide mounts, of 8 mm. and a wing length the same in the specimens at hand. It differs from *americana* in color, the thorax having a rather conspicuous pale median stripe, the humeral processes and a basal area about each of them rather yellowish, the scutellum yellowish basally and head and thorax with a conspicuous vestiture of pale, yellowish hairs. The pattern of setae is the same as in *americana,* but the seta are much more numerous justifying Speiser's name *acarta* (unshorn). The accompanying figures of the head (Fig. 5*H*) and the humeral processes (Fig. 5*C*), compared with the same structures in *L. americana* and *L. angustifrons* will indicate clearly the extent of this tendency.

The wings have the same general patterns of setulae as in *L. americana* but there is a marked invasion of the basal area (Fig. 5*B*). The sub-costa attains the costa and the "first cross-vein" is almost behind the end of R_1. The thickening of the costal border beyond the end of R_1, which was noted by Speiser, is evident.

The palpi (Fig. 5*H*) are noticeably short..

The lateral margins of the mesothorax, small areas at the side of the head just behind the eyes and small areas at each side at the base of the scutellum show a grey pollinosity. Slide preparations show in these areas the appearance which is discussed later in this paper and which is perhaps responsible for this pollinosity.

Genus *Lipoptena* Nitzsch.

Lipoptena mazamae (Rondani).

1922. *Lipoptena mazamae* (Rondani), Ferris and Cole, Parasit. 14: 185: f. 2A, 2E.

Previous records. From *"Cervus mexicanus,"* Central America and *Mazama* sp., Bolivia.

Present record. From *Mazama sartorii reperticia,* Camp Pital, Chiriqui Province, Panama (*L. H. Dunn*).

Genus *Ornithoica* Rondani.

Ornithoica confluenta (Say).

Present record. A single male from toucan, *Ramphastos swainsonii,* Camp Pital, Chiriqui Province, Panama (L. H. Dunn).

Notes: This specimen agrees in every detail with specimens from the United States.

THE NATURE OF POLLINOSITY.

In various species of the genera *Olfersia* and *Lynchia* areas of pollinosity occur on the head and thorax, these areas having an appearance as if the insect were dusted with a gray powder. They are quite conspicuous in pinned specimens but are obscured in slide preparations. The correlation of these areas, as they appear in pinned mounts, with some morphological feature that persists in slide preparations is of some importance.

A careful examination of *Olfersia vulturis, O. spinifera* and *Lynchia intertropica* reveals such a correlation. The areas which are pollinose in the pinned mount appear under the higher powers of the microscope as beset with minute and very slender spines or setae. These are so extremely small that they can not be seen with the lower powers of the compound microscope. I have been unable to determine whether they are spines or setae. Whether the pollinose appearance is due to some secretion which originates from these areas, or whether it is the result of the breaking up of light by the minute points I have been unable to determine. No pores through which a secretion might exude can be detected and experience with groups such as the Coccidae indicates that such pores would be necessary. It appears probable therefore that the effect is due to the breaking up of the light. Whether the pollinosity which appears in other Diptera can be correlated with a similar appearance of the derm has not been determined.

Mailed Monday, March 31st, 1930.